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Ref: Election Restricting Claims Under 35 U.S.C. 121 for Application 10/735,792 (Garrison, et al)

Dear Mr. DeMille,

Thank you for the Office Action dated March 23, 2007 and mailed on March 30, 2007. In it you notify the inventors of the requirement to restrict their claims by electing a single disclosed species and listing claims readable thereon.

The inventors (I am their attorney as well as an inventor on this application) elect to restrict claims to an apparatus for facilitating respiratory function. The following claims are readable thereon:

1. An apparatus for facilitating respiratory functions in a subject, comprising: (a) a removable wrap adapted for encircling the torso portion of a body; (b) a plurality of channels in the wrap for expanding and contracting the wrap in response to a stimulus; (c) a drive system for stimulating the wrap to expand and contract the wrap for simulating respiration in the subject.

2. The apparatus of claim 1, wherein the wrap further includes a feedback system for monitoring the condition of the subject.

3. The apparatus of claim 2, wherein the feedback system comprises a set of sensors attached to the subject for monitoring cardiovascular vital signs.

4. The apparatus of claim 2, wherein the feedback system comprises a set of sensors attached to the subject for monitoring temperature.

5. The apparatus of claim 2, wherein the feedback system comprises a set of sensors attached to the subject for monitoring pH and blood gases.

6. The apparatus of claim 2, wherein the feedback system comprises a set of sensors attached to the subject for monitoring EEG and EKG and subarachnoid pressure.

7. The apparatus of claim 2, wherein the feedback system comprises a set of sensors and a set of probes attached to the subject for monitoring and optimizing ventilatory and heart rate parameters.

8. The apparatus of claim 1, wherein the wrap encircles the torso and extends from an upper terminus just below the armpits of the subject to a lower terminus beneath the diaphragm of the subject.

9. The apparatus of claim 1, wherein the wrap encircles the torso and extends from an upper terminus near the diaphragm of the subject to a lower terminus just above the groin of the subject.

10. The apparatus of claim 1, wherein the channels are a set of airtight chambers and wherein the drive system comprises a pump for pumping air into and out of the chambers.

11. The apparatus of claim 2, wherein the drive system is responsive to the feedback system to adjust the respiratory assist function dependent upon the monitored condition of the subject.

12. The apparatus of claim 1, wherein the wrap further comprises a garment, said garment comprising a plurality of pressure cuffs, said plurality of pressure cuffs comprising: (i) a set of pressure cuffs encircling the torso of the subject, and (ii) a set of pressure cuffs encircling the extremities of the subject.

13. The apparatus of claim 12, wherein the garment is transparent to allow visual access to selected body areas.

14. The apparatus of claim 12, wherein the pressure cuffs are elastic.

15. The apparatus of claim 12, wherein the plurality of pressure cuffs further include: (a) forearm cuffs, extending approximately from wrist to elbow; (b) leg cuffs, extending approximately from ankle to knee; (c) arm cuffs, extending approximately from elbow to axilla; (d) thigh cuffs, extending approximately from knee to groin; (e) an abdominal cuff, extending approximately from pubis to subcostal margin; and (f) a breast-conforming thoracic cuff, extending approximately from subcostal margin to infraclavicular area.

16. The apparatus of claim 12, wherein the garment is jointed to allow for full

and ready access to the body at head, neck, hands, feet, elbows, knees, pelvic girdle, shoulder girdle, and thoraco-abdominal junction.

17. The apparatus of claim 12, wherein the garment is jointed and each cuff includes detachable cuff segments to allow full and ready access to any selected body part.

18. The apparatus of claim 12, wherein the thoracic cuff further includes embedded cutaneous electrical contacts for electrocardiography and defibrillation.

19. The apparatus of claim 12, wherein the thoracic cuff further includes embedded vibrating devices for pulmonary toilet.

20. The apparatus of claim 15, further including a securing system for preventing migration of the cuffs, said securing system comprising shoulder straps on the thoracic cuff, ankle stirrups on the lower leg cuffs, and straps connecting all cuffs to each other.

21. The apparatus of claim 12, wherein each pressure cuff further includes a set of expandable chambers for receiving a medium wherein the set of chambers expands to apply pressure to the body part enclosed by that cuff.

22. The apparatus of claim 21, wherein the medium is a gas.

23. The apparatus of claim 21, wherein the medium is an electroexpansile gel.

24. The apparatus of claim 21, wherein the medium is a liquid.

25. The apparatus of claim 21, wherein the medium is adapted to be temperature-conditioned.

26. The apparatus of claim 1, wherein the drive system is adapted for selectively applying pressure to different parts of the body of the subject for inducing the subject to breathe outward thereby expiring air from lungs of the subject.

27. The apparatus of claim 1, wherein the drive system is further adapted for promoting circulation of blood from the extremities of the subject to the head of the subject.

28. The apparatus of claim 1, wherein the drive system is further adapted to facilitate electro cardiographic gating for reducing impairment of arterial circulation by relieving increased preloading momentarily during a cardiac cycle.

29. The apparatus of claim 1, further including: (a) a heated and cooled reservoir for storing a transportable medium at a chosen temperature to fill the channels in the wrap; (b) a pump to supply the medium to the channels; (c) a set of lines for transporting the medium from the reservoir to the channels; and (d) a processing device for controlling the flow of the medium to each respective channel.

30. The apparatus of claim 29, further including a controller for accepting inputs from the various sensors for controlling the pump for managing the flow of the medium into and out of the channels.

31. The apparatus of claim 30, further including thermostatic controls for the heating and cooling of the medium.

32. The apparatus of claim 31, wherein the thermostatic controls include provision for deliberate hypothermia, hyperthermia, and appropriate responses to fever.

33. The apparatus of claim 30, further including a coordinated positive pressure inspiratory ventilator for allowing control of at least one simultaneously administered aerosolized pharmaceuticals for automatic control of airway resistance and automatic control of respiratory rate, tidal volume, and inspired oxygen concentration to achieve desired arterial pH and blood gas concentrations in the subject.

34. The apparatus of claim 33, further including an endotracheal tube for connecting the subject to an inspiratory path from the ventilator, said endotracheal tube having an airtight and autosealing side port for insertion of a suction catheter into the trachea of the subject.

35. The apparatus of claim 34, wherein the controller, in response to the received inputs, causes the suction catheter to insert into the trachea of the subject, suction the right mainstem bronchus of the subject, and withdraw from the subject.

36. The apparatus of claim 35, wherein the controller, in response to the received inputs, causes the suction catheter to rotate approximately 180 degrees, insert into the trachea of the subject, suction the left mainstem bronchus of the subject, and withdraw from the subject.

37. The apparatus of claim 34 wherein the endotracheal tube connects the subject to an expiratory path comprising an artificial glottis.

38. The apparatus of claim 37, wherein the controller, in response to the received inputs, causes the artificial glottis to: (i) close prior to expiration of the subject whereby pressure behind the artificial glottis increases to a

predetermined level, and (ii) open once the predetermined pressure is reached thereby achieving a cough.

39. The apparatus of claim 37, wherein the controller, in response to received inputs, causes the artificial glottis to: (i) close at the end of inspiration and remain closed for a predetermined period of time wherein the subject may be transferred from the apparatus to another device for respiratory assistance.

40. The apparatus of claim 37, further comprising: (a) a voice box connected to the expiratory path distal to the artificial glottis; and (b) a set of EMG sensors attached to the endotracheal tube for receiving and sending arytenoid information to the artificial glottis and voice box whereby said voice box converts the arytenoid information into recognizable vocalization to facilitate speech while the subject is intubated.

41. The apparatus of claim 37, further comprising: (a) an electronic or electromechanical voice synthesis device voice box connected to the expiratory path distal to the artificial glottis; and (b) a set of EMG sensors attached to the endotracheal tube for receiving and sending arytenoid information to the artificial glottis and voice synthesis device whereby said voice synthesis device converts the arytenoid information into recognizable vocalization to facilitate speech while the subject is intubated.

42. The apparatus of claim 15, wherein the thoracic cuff includes a set of electrocardiogram leads.

43. The apparatus of claim 42, wherein the thoracic cuff further includes an integrated pair of anterior and posterior plates to facilitate defibrillation by process of applying a manually or automatically applied electronic shock to the heart of the subject.

44. The apparatus of claim 43, wherein the thoracic cuff still further includes a set of integrated vibration devices for facilitating pulmonary toilet in the subject.

45. The apparatus of claim 1, wherein said apparatus is adapted to facilitate portability of the subject.

46. The apparatus of claim 45, wherein said apparatus is adapted to fit into a fully-configured patient bed.

47. The apparatus of claim 45, wherein said apparatus is adapted to fit into a fully-configured manual and/or powered cart.

48. The apparatus of claim 45, wherein said apparatus is adapted to fit into a fully-configured automobile.

49. The apparatus of claim 45, wherein said apparatus is adapted to fit into a wall mounting.

50. The apparatus of claim 1, further comprising: (a) a ventilator for supplying breathable air to the subject to facilitate inspiration; (b) a purification device for processing expired air from the subject to remove carbon dioxide and other expired waste to produce a cleansed air; (c) an inspiratory path from the ventilator to the subject to deliver the breathable air; (d) an expiratory path from the subject to the purification device to deliver the expired air; and (e) a recycle path from the purification device to the ventilator to deliver the cleansed air.

51. The apparatus of claim 1, further comprising: (a) a ventilator for supplying breathable liquid to the subject to facilitate inspiration; (b) a purification device for processing expired liquid from the subject to remove carbon dioxide and other expired waste to produce a cleansed liquid; (c) an inspiratory path from the ventilator to the subject to deliver the breathable liquid; (d) an expiratory path from the subject to the purification device to deliver the expired liquid; and (e) a recycle path from the purification device to the ventilator to deliver the cleansed liquid.

52. The apparatus of claim 50, wherein said apparatus being arranged for use as a diving and/or pressure suit in an underwater environment.

53. The apparatus of claim 50, wherein said apparatus being arranged for use as a G-suit in an aerial and/or outer space environment.

54. The apparatus of claim 51, wherein said apparatus being arranged for use as a diving and/or pressure suit in an underwater environment, said apparatus for enclosing the subject within a reservoir of similar fluid as the breathable liquid.

55. The apparatus of claim 51, wherein said apparatus being arranged for use as a G-suit in an aerial and/or outer space environment, said apparatus for enclosing the subject within a reservoir of similar fluid as the breathable liquid.

56. The apparatus of claim 1, wherein said apparatus being arranged for use as a G-suit in a cockpit of an aerial vehicle.

57. The apparatus of claim 33, wherein said apparatus is adapted to facilitate portability of the subject.

58. The apparatus of claim 33, wherein said apparatus being arranged for use as a G-suit in a cockpit of an aerial vehicle.

59. An apparatus for facilitating respiratory and circulatory functions in a patient, comprising: (a) a garment of pressure cuffs to be adorned by the patient, said garment comprising: (i) a breast-conforming thoracic cuff extending approximately from subcostal margin to infraclavicular area, (ii) an abdominal cuff extending approximately from pubis to subcostal margin, (iii) a set of forearm cuffs, each forearm cuff extending approximately from wrist to elbow, (iv) a set of lower leg cuffs, each lower leg cuff extending approximately from ankle to knee, (v) a set of upper arm cuffs, each upper arm cuff extending approximately from elbow to axilla, and (vi) a set of thigh cuffs, each thigh cuff extending approximately from knee to groin; each of said cuffs comprising a set of bladders for receiving an expanding medium; (b) a feedback system comprising a set of sensors attached to the patient for monitoring patient-related variables; (c) a drive system comprising a pump, a reservoir for holding the expanding medium, and a set of flow lines for connecting reservoir to each of the pressure cuffs via the pump and a set of control valves, said drive system for delivering the expanding medium to the pressure cuffs in accordance to a pressuring sequence; and (d) a controller system comprising a PLC, said controller system connected to the feedback system and the drive system, said controller system for establishing the pressuring sequence, said sequence determined by analysis of the patient-related variables monitored by the feedback system.

60. The apparatus of claim 59, wherein the thoracic cuff further includes an integrated pair of anterior and posterior plates to facilitate defibrillation by process of applying an electronic shock to the heart of the patient

61. The apparatus of claim 59, wherein the patient-related variables to be monitored by the feedback system are selected from the group consisting of: cardiovascular vital signs, temperature of the patient, pH and blood gas levels, EEG, EKG, and subarachnoid pressure, ventilatory parameters, arytenoid EMG information from the larynx of the patient, and pulmonary noise.

62. The apparatus of claim 61, wherein the thoracic cuff further includes an integrated pair of anterior and posterior plates to facilitate defibrillation by process of applying an electronic shock to the heart of the patient.

63. The apparatus of claim 59, further comprising a heating and cooling device connected to the reservoir of expanding medium, said heating and cooling device for managing the temperature of the expanding medium pursuant to directions from the controller system.

64. The apparatus of claim 63, wherein the thoracic cuff further includes an integrated pair of anterior and posterior plates to facilitate defibrillation by process of applying an electronic shock to the heart of the patient.

65. The apparatus of claim 59, further comprising: (a) a ventilator for providing inspiratory functions to the patient; and (b) an endotracheal tube for connecting the patient to ventilator, said endotracheal tube comprising a port for receiving a suction catheter and a T-piece for defining an inspiratory-only path from the ventilator to the patient and an expiratory-only path from the patient to an outlet.

66. The apparatus of claim 65, wherein the thoracic cuff further includes an integrated pair of anterior and posterior plates to facilitate defibrillation by process of applying an electronic shock to the heart of the patient.

67. The apparatus of claim 65, wherein the ventilator is a coordinated positive pressure inspiratory ventilator for allowing control of aerosolized pharmaceuticals for control of airway resistance and automatic control of respiratory rate, tidal volume, and inspired oxygen concentration to achieve desired arterial pH and blood gas concentrations in the patient.

68. The apparatus of claim 65, wherein the controller system, in response to the patient-related variables monitored by the feedback system, causes the suction catheter to insert into the port of the endotracheal tube to facilitate pulmonary suctioning of the patient.

69. The apparatus of claim 65 wherein the outlet of the expiratory-only path comprises a glottal valve.

70. The apparatus of claim 69, wherein the controller system, in response to the patient-related variables monitored by the feedback system, causes the glottal valve to: (i) close prior to expiration of the patient whereby pressure behind the glottal valve increases to a predetermined level, and (ii) open once the predetermined pressure level is reached thereby achieving a cough.

71. The apparatus of claim 59, wherein the control system, in response to the patient-sent to the glottal valve to facilitate speech while the patient is intubated.

72. The apparatus of claim 59, wherein the pressuring sequence comprises the following order: (i) first, pressurization of the set of forearm cuffs and the set of lower leg cuffs, (ii) second, pressurization of the set of upper arm cuffs and the set of thigh cuffs, (iii) pressurization of the abdominal cuff, and (iv) pressurization of the breast-conforming cuff-related variables monitored by the feedback system, causes arytenoid information to be.

Sincerely,

Tariq A. Khan

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